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Multistudy Report

Construct Validity of the French Shirom-Melamed Vigor Measure (F-SMVM)

A Multitrait-Multimethod (MTMM) Approach

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Abstract: Work vigor is defined by cognitive, affective, and behavioral components. The purpose of this multi-study paper was to develop a French version of the Shirom-Melamed Vigor Measure (F-SMVM), and test its (a) construct validity (i.e., factorial structure and internal consistency), (b) convergent and discriminant validity with the Utrecht Work Engagement Scale (UWES-9), and (c) concurrent validity with work motivation and job satisfaction. Six hundred and forty (61.72% female) employees participated in the three present studies. Convergent and discriminant construct validity of the F-SMVM were examined with a confirmatory factor analysis (CFA) and a multitrait-multimethod (MTMM) analysis. Concurrent validity was examined through correlations and regressions with work motivation and job satisfaction. Overall, the results supported the reliability and the construct validity of the F-SMVM. They also showed evidence of convergent validity between the F-SMVM and the UWES-9, as well as evidence of concurrent validity with work motivation and job satisfaction. The F-SMVM represents a valid measure assessing three interrelated dimensions representing physical, cognitive, and emotional components of work engagement.

Keywords: engagement, motivation, multitrait-multimethod analysis, vigor, workplace

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In the professional context, all employees want to feel vigorous, especially when their work takes an important place in their lives. Feeling invigorated at work has been proposed to lead to a series of positive consequences such as job satisfaction, mental and physical health, job performance, and organizational effectiveness (Shirom, 2011). As a result, more and more research has focused on the concept of vigor at work (e.g., Melamed & Shirom, 2012; Shirom, Toker, Berliner, Shapira, & Melamed, 2008; Shraga & Shirom, 2009). Vigor is one of the two major conceptualizations of engagement at work (Wefald, Mills, Smith, & Downey, 2012); the other is work engagement (Schaufeli, Salanova, González-Romá, & Bakker, 2002). These two concepts are considered to represent two different constructs sharing some similarities, but which are not interchangeable (Wefald et al., 2012). Work engagement measured by the Utrecht Work Engagement Scale (UWES) and vigor measured by the Shirom Melamed Vigor Measure (SMVM) are considered as two valid measures of engagement at work[1] (Wefald et al., 2012). However among French-speaking workers, the measure of vigor has not been translated and validated, even though this concept is generating growing interest for researchers and practitioners among these workers. Increasing interest in cross-cultural studies (International Test Commission [ITC], 2018) have also required valid tools in different languages.

As a result, in the present multi-study paper, we developed a French version of the Shirom-Melamed Vigor Measure (F-SMVM), and (a) tested its construct validity, (b) analyzed its convergent and discriminant validity with the UWES-9 through a multitrait-multimethod (MTMM) approach, and (c) examined the concurrent validity and the contribution of both of the F-SMVM and the UWES-9 in the variation of motivation and satisfaction at work.

[1] Valid measures of engagement have to capture characteristics of the response and not characteristics of the work itself (Simmons, 2012).

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Based on the need to have accurate definition and instrument to measure vigor, Shirom (2003) developed a multidimensional conceptualization of *vigor at work*. He advanced that vigor is an individual feeling of (a) *physical strength* (i.e., feeling of high level of energy in carrying out daily tasks at work), (b) *emotional energy* (i.e., feeling of having capacities to invest emotionally in relationships with clients and/or coworkers), and (c) *cognitive liveliness* (i.e., feeling of having thinking skills and mental agility). In this conceptualization, physical strength, emotional energy, and cognitive liveliness are considered as resources (i.e., "those personal energies and characteristics, objects and conditions that are valued by individuals or that served as the means for the attainment of other objects, personal characteristics, conditions or energies"; Shirom, 2003, p. 143) which are inter-related. Vigor has been supposed to be associated with highly important outcomes such as motivation, job performance and effectiveness, physical and mental health, and job satisfaction (Shirom, 2011). Several antecedents of vigor have also been identified such as job characteristics, supervisor's leadership style, participation in decision making, and job significance (Shirom, 2011).

Based on his conceptualization, Shirom (2003) developed a questionnaire (i.e., the Shirom-Melamed Vigor Measure; SMVM) measuring the three components of vigor among workers from all type of occupations (and with different educational backgrounds). The first version was composed of 14 items and then has been reduced to 12 items (Shirom, 2005). Since its development, preliminary results have been promising in establishing its validity (Shirom, 2003; Shraga & Shirom, 2009), and researchers have stressed the importance of using this alternative measure of work engagement in order to have a deeper view of possible consequences in the workplace, such as motivation, job satisfaction, and affective commitment (Wefald et al., 2012).

In the meantime, Schaufeli, Salanova, et al. (2002) defined *work engagement* as a positive mindset, a feeling of fulfillment (from the work). It is characterized by physical-energetic, emotional, and cognitive components, referred to respectively as (a) *vigor* (i.e., high levels of energy and mental resilience, enthusiasm to invest efforts in the work and persistence in face of difficulties), (b) *dedication* (i.e., strong involvement in the work and experience of a sense of importance, excitement, and challenge), and (c) *absorption* (i.e., being completely captivated by the work so that time passes quickly). Based on this multidimensional conceptualization of work engagement, Schaufeli, Bakker, and Salanova (2006) built the UWES to assess this construct. In the literature on work engagement, this scale has been the most widely used measure (Christian, Garza, & Slaughter, 2011) and its three-dimensional structure has received strong support (Schaufeli et al., 2006; Schaufeli, Martinez, Pinto, Salanova, & Bakker, 2002; Schaufeli, Salanova, et al., 2002). However, a recent literature review on the UWES (Kulikowski, 2017) has revealed that this three-dimensional structure was not found in all the studies using the UWES. Engagement has been associated with outcomes such as job performance and to several antecedents such as job and personal resources (Bakker & Demerouti, 2018).

Although, Shirom's conceptualization of vigor is intended to be different from Schaufeli's conceptualization of work engagement on a theoretical basis,[2] these two conceptualizations share several similarities. First, they both represent indicators of a positive state directed toward one's work (Wefald et al., 2012). Next, based on the definitions of work engagement (Schaufeli, Salanova, et al., 2002) and vigor (Shirom, 2003), it seems that the three dimensions of each construct share some similarities. Indeed, the *physical strength* component of vigor and the *vigor* dimension of work engagement both represent physical-energetic dimensions; the *cognitive liveliness* component of vigor and the *dedication* dimension of work engagement both represent cognitive dimensions; and the *emotional energy* component of vigor and the *absorption* dimension of work engagement both represent emotional dimensions (Bakker, Schaufeli, Leiter, & Taris, 2008; Shirom, 2011). However, these two constructs have also some differences. The work engagement construct of Schaufeli has a *vigor* dimension which represents a set of evaluative and attitudinal dimensions, whereas the vigor construct of Shirom represents the physical, emotional, and cognitive dimensions of vigor (Shirom, 2011). Moreover, in Shirom's conceptualization of vigor, vigor is seen as an effect, while the dimension of *vigor* in Schaufeli's conceptualization of work engagement includes high levels of energy, motivation to invest effort in work, and resilience. Therefore, the latter is different from an affective state (Shirom, 2011).

Objectives of the Present Multi-Study

In line with past studies, a number of limitations appear. First, there has been little empirical evidence of the SMVM construct validity (Little, Nelson, Wallace, & Johnson, 2011). Moreover, as far as is known, no study has examined the convergent and discriminant validity of the SMVM and the UWES-9 with MTMM analysis. In view of the

[2] *Work engagement* is defined as a positive mindset, a feeling of fulfilment (from the work), whereas *vigor* is defined as an individual feeling of physical, emotional, and cognitive energy at work.

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differences and similarities between these two constructs, it seems relevant to examine their validity using this method. Indeed, this one makes it possible to examine the convergence and the divergence between two constructs. Finally, even if the SMVM has been validated in different languages (i.e., Turkish, Thai, Norwegian, English, Spanish; Bilgel, Bayram, Ozdemir, Dogan, & Ekin, 2012; Boonyasiriwat, Srisuwannatat, & Puttaravuttiporn, 2017; Furunes & Mykletun, 2012; Little et al., 2011; Pulido-Martos, Meléndez-Domínguez, & Lopez-Zafra, 2017) it has not been validated in French. Having a valid measure in French will allow for further research on the vigor of French-speaking workers and for cross-cultural studies. As a result, the first objective of this study was to develop a F-SMVM, and explore its construct validity by examining its reliability, and its factorial structure. The second objective was to deepen the construct validity of the F-SMVM by assessing the extent to which the F-SMVM converges with the UWES definition of work engagement (i.e., convergent validity), and if the three dimensions of work engagement (i.e., physical, emotional, and cognitive work engagement) diverge from each other (i.e., discriminant validity with a MTMM analysis). The third objective of this study was to examine the concurrent validity and the contribution of the F-SMVM and the UWES-9 in the variation of motivation and satisfaction at work.

Study 1: Factorial Validity of the F-SMVMv1

The objective of this first study was to develop a preliminary F-SMVMv1 and examine its reliability and its construct validity by investigating its factorial structure. As far as we know, no study has tested the SMVM among French-speaking workers, although the study of well-being at work is a major preoccupation. In the process of validating/developing scales, it is suggested that measures must be theoretically sound ("what is the construct being measured"; Ziegler, 2014, p. 1), empirically distinct, and of practical importance to both academics and practitioners ("what are the intended uses of the measure" and "what is the target population"; Ziegler, 2014, p. 1). We hypothesized that the three dimension structure proposed by Shirom (2003) would be valid in the French culture (i.e., pan-human validity; Segall, Lonner, & Berry, 1998).

Method

Participants and Procedure

After having secured ethical approval from the Ethics Committee for Non-Interventional Studies at the University in which the study was conducted, the questionnaire was distributed as a web survey to administrative and technical university staff, representing a potential of around 1,500 participants. Of these, 301 completed a useable questionnaire, giving a response rate of 20%[3] (Baruch & Holtom, 2008). The participants (206 females and 95 males) who completed the survey had a mean age of 42.95 years (*SD* = 10.05). They had a mean work experience of 12.59 years (*SD* = 10.02), and worked an average of 37.12 hr per week (*SD* = 6.46). This sample comprised 134 professional and managerial workers (44.52%), 53 intermediate occupations (17.61%), and 114 lower supervisory and technical employees (37.87%).

Measure

The SMVM (Shirom, 2005) consists of 12 items scored on a 7-point frequency scale ranging from 1 (= *almost never*) to 7 (= *almost always*), assessing *physical strength* (five items; e.g., "I feel energetic"), *emotional energy* (four items; e.g., "I feel able to show warmth to others"), and *cognitive liveliness* (three items; e.g., "I feel able to be creative") (Table 1). Respondents were requested to indicate the frequency of experiencing each of the described states during the previous 30 workdays. Translation of the original version of the SMVM was developed by two bilingual individuals, using a back translation procedure (Brislin, 1986). Then a procedure of reconciliation was used with an expert panel (i.e., the authors of the present study). In this approach, the expert panel has identified the discrepancies between the translation and the back-translation, and reconciles them into a single item. The panel of experts has the following skills: knowledge of both languages, of the French working culture, of the content of the test, and of the general principles of testing (ITC, 2018). Based on this procedure, eight items have been discussed and reformulated to be adapted to the French working population.

Statistical Analyses

Statistical analyses were performed with SPSS 20 and AMOS 21 programs. The complete data are listed in the Electronic Supplementary Material, ESM 1. The three-dimensional factorial validity of the F-SMVM was examined with a confirmatory factor analysis (CFA), using a

[3] Several reasons may explain this low response rate. First of all, some employees may have been on vacation at the time of the study and therefore were unable to respond within the required time frame. Second, because university staff are regularly asked to participate in studies, they may have been reluctant to participate either because they are overly solicited or because they were too busy. Finally, given the nature of the questionnaire (i.e., workplace well-being questionnaire), some employees may have been reluctant to participate because they did not wish to respond to this type of questionnaire.

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Table 1. 12-items from the original SMVM and the second French version of the SMVM

Original SMVM		Second French version of the SMVM
	Physical strength	*Force physique*
1	I feel full of pep	Sentiment d'avoir la pêche
3	I feel I have physical strength	Sentiment d'avoir de la force physique
7	Feeling vigorous	Sentiment de vigueur
9	I feel energetic	Sentiment d'avoir de l'énergie
11	Feeling of vitality	Sentiment de vitalité
13		Sentiment de dynamisme
	Cognitive liveliness	*Vivacité cognitive*
2	I feel I can think rapidly	Sentiment de réfléchir rapidement
5	I feel I am able to contribute new ideas	Sentiment de contribuer à de nouvelles idées
10	I feel able to be creative	Sentiment d'être créatif(ve)
14		Sentiment de vivacité d'esprit
	Emotional energy	*Energie émotionnelle*
4	I feel able to show warmth to others	Sentiment d'être chaleureux(se) avec les autres (collègues, clients…)
6	I feel able to be sensitive to the needs of coworkers and customers	Sentiment d'être attentif(ve) aux besoins des autres (collègues, clients…)
8	I feel I am capable of investing emotionally in coworkers and customers	Sentiment de m'investir sur le plan émotionnel avec les autres (collègues, clients…)
12	I feel capable of being sympathetic to co-workers and customers	Sentiment d'être compatissant(e) envers les autres (collègues, clients…)
15		Sentiment de comprendre les idées et/ou émotions des autres (collègues, clients…)

Note. SMVM = Shirom Melamed Vigor Measure.

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maximum likelihood estimation. Actually, some researchers recommend to use maximum likelihood estimation when there are five or more categories in a scale, when sample size is small, and when category thresholds are approximately symmetric (Rhemtulla, Brosseau-Liard, & Savalei, 2012). Moreover, it is possible to find true parameter values in factor analysis with Likert scale data, if assumptions about skewness and kurtosis are met (Lubke & Muthén, 2004). Based on the suggestions made by several researchers (Brown, 2015), multiple indices were chosen to assess model fit: the Comparative Fit Index (CFI), the Root Mean Square Error of Approximation (RMSEA), the Standardized Root Mean Squared Residual (SRMR), the Tucker-Lewis Index (TLI), and the Akaike Information Criterion (AIC). A good model fit is indicated by RMSEA $\leq$ .05, with the lower value of the 90% confidence interval including or being very near zero (or no worse than .05) and the upper value being less than .08, SRMR $\leq$ .05, and TLI, CFI $\geq$ .95; and a reasonable model fit is indicated by RMSEA, SRMR < .08, and TLI, CFI $\geq$ .90 (Brown, 2015). The AIC was used in models' comparison, with lower values supporting a better fitting model.

Results

Descriptive Statistics

Univariate and multivariate normality were examined. The results showed that univariate skewness and kurtosis values were lower than 1 and Mardia's multivariate skewness and kurtosis values were lower than 3. Inspection of the interfactorial correlations between latent factors revealed that cognitive liveliness subscale was positively correlated to physical strength subscale (r = .63, p < .001) and to emotional energy subscale (r = .32, p < .001); and that physical strength subscale was positively correlated to emotional energy subscale (r = .29, p < .001).

Reliability and Factorial Validity of the F-SMVMv1

The reliability of the F-SMVMv1 was then assessed by examining the Cronbach's alpha coefficients of the three subscales with items assumed to be theoretically dedicated to each scale. The results provided evidence for good internal consistency (i.e., Cronbach's α of physical strength = .94, Cronbach's α of cognitive liveliness = .82, and Cronbach's α of emotional energy = .82). The fit indices of the measurement model that specified the 3-factor F-SMVMv1 reached acceptable values for SRMR, CFI, and TLI but showed inacceptable RMSEA values: $\chi^2(51)$ = 224.990; TLI = .912; CFI = .932; RMSEA = .107 (90% CI [.093, .121]); SRMR = .060; AIC = 302.990. Although studies have demonstrated the validity of different SMVM factor structures (e.g., one second-order factor and three first-order factors, Bilgel et al., 2012; Little et al., 2011; Shirom et al., 2008; Wefald et al., 2012) in the present study we tested the three-dimensional first-order structure in order to be

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able to use this structure in MTMM analyses. However, a hierarchical model has also been tested and led to quasi-similar results (see ESM 3 for standardized factor loadings, correlations of the latent constructs, standardized residual variances, and fit indices of the two models). Inspection of the modification indices provided by the AMOS software revealed that four items exhibited cross-loadings on other dimensions of the SMVM (cognitive liveliness 2 with physical strength subscale, $\Delta\chi^2 = 33.63$; physical strength 11 with cognitive liveliness subscale, $\Delta\chi^2 = 23.63$; physical strength 3 with cognitive liveliness subscale, $\Delta\chi^2 = 14.89$; and cognitive liveliness 5 with physical strength subscale, $\Delta\chi^2 = 10.62$). Three pairs of items had a high shared covariance (physical strength 1 with physical strength 3, $\Delta\chi^2 = 22.00$; cognitive liveliness 10 with physical strength 11, $\Delta\chi^2 = 15.18$; and physical strength 3 with cognitive liveliness 5, $\Delta\chi^2 = 11.40$). Since the modification indices reveal that some items have cross-loadings on dimensions to which they are not related theoretically, and that several items not belonging to the same dimension have a high shared covariance, we have not proceeded to these modifications that go against the theoretical assumptions of the SMVM.

Conclusion

The objective of this first study was to test the reliability and the factorial validity of the F-SMVMv1. Results of the CFA analysis revealed an inadequate model, and inspection of the modification indices revealed that several items showed high-shared covariance or cross-loading while this was not reported in the original SMVM (Shirom, 2003; Shirom et al., 2008). One may think that correlations among residuals observed in the present study are caused by overlap in the items wording. Actually, in the French translation of the items, seven items started with "I feel…" and five items started with "I feel I am able…". As a result, a modified version of the items has been proposed and tested for factorial, convergent, discriminant, and concurrent validity in the following studies.

Study 2: Factorial, Convergent, and Discriminant Validity of the F-SMVMv2

The first objective of this study was to develop a revised F-SMVM (i.e., the F-SMVMv2). In line with the results of the previous study, the expert panel decided to standardize the item wordings as they all begin with "feeling of…", in order to limit the item overlap. Moreover, on the basis of the definition proposed by Shirom for each vigor dimension, the expert panel created three new items (one per dimension) in order to have a sufficient number of items in each dimension in the event that one or more of the items would reveal themselves unsatisfactory, and so as to have a balanced number of items per dimension. Insofar as the SMVM examines the employees' level of vigor in various job contexts, and among employees with various educational backgrounds, a simple and clear formulation of the items is required. In order to ensure the content validity of the modified and created items, we followed the guidelines of the ITC (2018). First, by selecting an expert panel as noted above, we ensured that the adaptation and creation of new items took cultural differences into account, and were consistent with Shirom's theoretical definition of the construct of vigor. Then, the expert panel made sure that the language used was natural and acceptable. Finally, the expert panel has also ensured that the format of the items corresponds to all categories of workers by simplifying the wording.

The second objective of this study was to examine the factorial structure and the reliability of the F-SMVMv2. The aim was to deepen the construct validity of the SMVM by assessing its convergence with the UWES definition of work engagement (i.e., convergent validity), and if the three dimensions of work engagement (i.e., physical, emotional and cognitive work engagement) diverge from each other (i.e., discriminant validity). Indeed, as noted in previous sections, Christian et al. (2011) noted that the UWES was the most popular measure of engagement, and Little et al. (2011) emphasized that there is a lack of evidence of the validity of the SMVM. In a recent comparison of these two measures, Wefald et al. (2012) concluded that the SMVM and the UWES are two valid measures of work engagement. We hypothesized that the SMVM and the UWES measure two different constructs linked to work engagement. In other words, these two constructs share similarities but are not interchangeable.

Method

Participants and Procedure

After having secured ethical approval from the Ethics Committee for Non-Interventional Studies at the University in which the study was conducted, the questionnaire was distributed as a web survey to employees of different companies representing a potential of 900 participants. Of these, 339 completed a useable questionnaire, giving a response rate of 37.67% (see Footnote 3). The participants (189 females and 150 males) who completed the survey had a mean age of 41.56 years (*SD* = 11.48). They had a mean work experience of 13.75 years (*SD* = 11.29), and worked

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Table 2. Latent correlation matrix of study 2 measures

	Cronbach's α	Mean	*SD*	Physical strength	Cognitive liveliness	Emotional energy	Vigor	Absorption
SMVM								
Physical strength	.91	5.11	0.90	_				
Cognitive liveliness	.78	4.91	0.84	.78***	_			
Emotional energy	.80	5.36	0.83	.45***	.59***	_		
UWES								
Vigor	.87	5.01	1.04	.82***	.70***	.48***	_	
Absorption	.83	5.08	1.02	.63***	.66***	.42***	.93***	_
Dedication	.88	5.09	1.23	.65***	.63***	.46***	.98***	.95***

Notes. SD = Standard Deviation; SMVM = Shirom Melamed Vigor Measure; UWES = Utrecht Work Engagement Scale. *$p < .05$, **$p < .01$, ***$p < .001$.

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an average of 38.18 hr per week (*SD* = 8.22). The employees comprised 119 professional and managerial workers (35.10%), 87 intermediate occupations (25.66%), and 133 lower supervisory and technical employees (39.24%).

Measures

Vigor

A revised version of the F-SMVMv1 consisting of 15 items (Table 1) was used in the present study. It scores on a 7-point frequency scale ranging from 1 (= *almost never*) to 7 (= *almost always*), and assesses *physical strength* (six items), *emotional energy* (five items), and *cognitive liveliness* (four items). Respondents were requested to indicate the frequency of experiencing each of the described states during the previous 30 workdays.

Engagement

The short French version (Gillet, Huart, Colombat, & Fouquereau, 2013) of the UWES known as the UWES-9 (Schaufeli et al., 2006) was used. This measure consists of nine items scored on a 7-point frequency scale ranging from 1 (= *almost never*) to 7 (= *almost always*), assessing *vigor* (three items; e.g., "In my job, I feel strong and vigorous"), *dedication* (three items; e.g., "I'm enthusiastic about my job"), and *absorption* (three items; e.g., "When I am working, I forget everything else around me"). The validity and reliability of the French version of this scale were supported in previous studies (e.g., Gillet et al., 2013).

Statistical Analyses

Statistical analyses were performed with SPSS 20 and AMOS 21 programs. Table 2 reports descriptive statistics, Cronbach's alpha, and correlations among the different dimensions. The complete data are listed in ESM 2. As in the previous study, the three-dimensional factorial validity of the F-SMVMv2 was examined with a CFA, using a maximum likelihood estimation. Then, convergent and discriminant validity between the F-SMVMv2 and the UWES-9 were examined with a MTMM analysis. MTMM organizes convergent and discriminant validity evidence for comparison of how one measure relates to another measure. A hypothesized model of trait- and method-influence on work engagement scores was tested for overall model fit. Trait factors (i.e., dimensions of work engagement) and method factors (i.e., measurement tools) were modeled as latent variables estimated by observed scores (i.e., self-reported scores on the three F-SMVMv2 subscales and on the three UWES-9 subscales).

The Correlated Trait-Correlated Method Minus One model (CT-C[M-1], Figure 1) was used in the present study (Eid, Lischetzke, Nussbeck, & Trierweiler, 2003). This model allows both trait factors and method factors to correlate, and a chosen comparison standard method is contrasted against the other method factors. The indicators of the comparison standard method do not have a method factor and are therefore only correlated to the trait factor (Eid et al., 2003). The UWES-9 was chosen as the comparison standard method as it is the most commonly used and a well-established tool (Christian et al., 2011). In the model, all indicators load on a trait – physical, cognitive, or emotional work engagement – defined by the comparison standard method (i.e., the UWES-9). The indicators also load on their specific standard method and cover the variance that is specific to the method and not shared with the comparison standard method. Trait correlations test the discriminant validity, with low correlations indicating high discriminant validity (i.e., traits measure different dimensions of work engagement; Eid et al., 2008).

Convergent validity was tested with consistency coefficients and method specificity. Consistency coefficients indicate the degree of true variance of an observed indicator of a method factor that is explained by the comparison method. Higher consistency coefficients (i.e., > 50%) indicate higher convergent validity. The method specificity coefficients represent the proportion of true variance in an observed indicator that is specific to the particular method factor and not shared with the comparison standard.

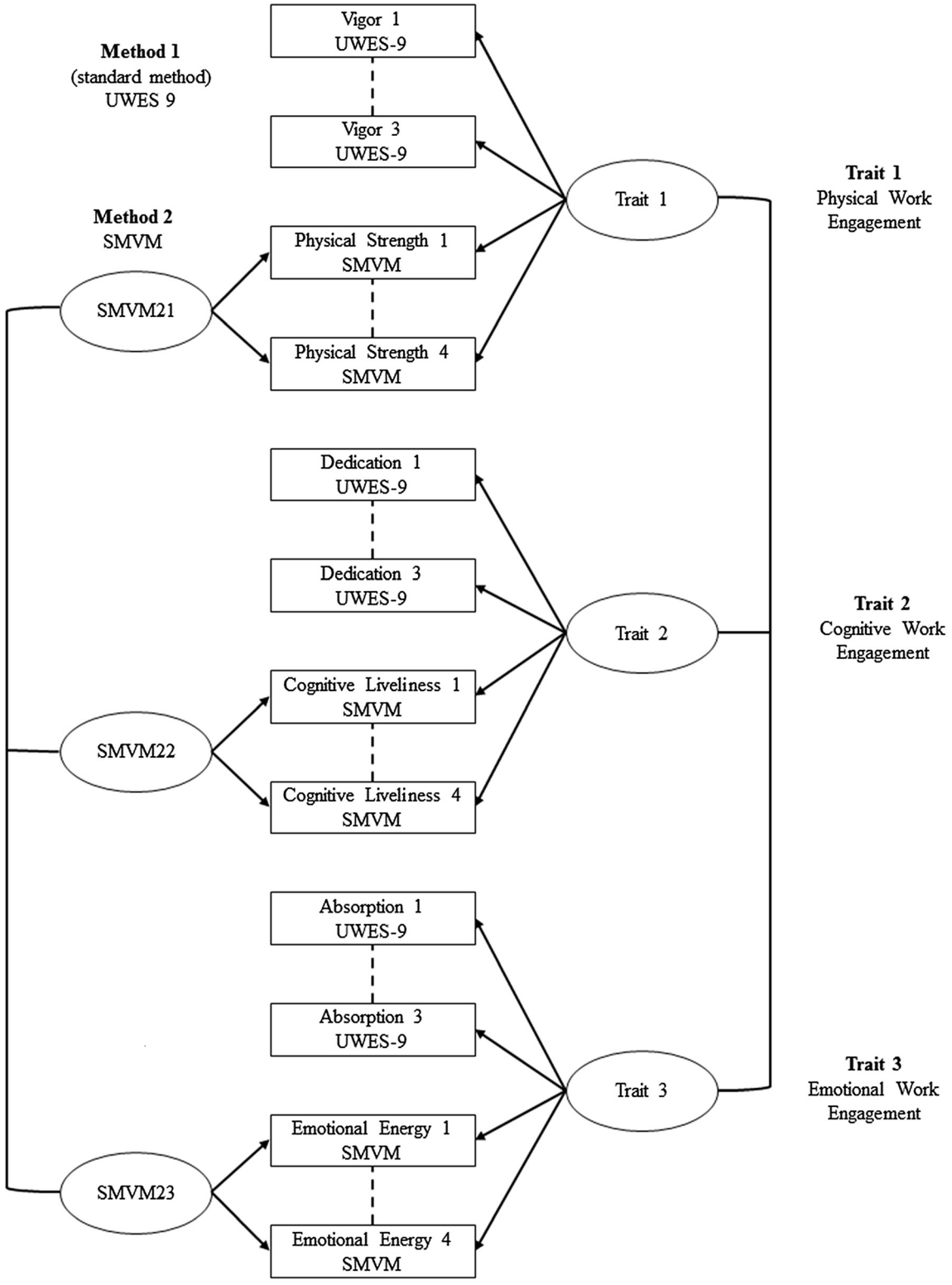

Figure 1. Correlated Trait-Correlated Method Minus One (CT-C[M-1]) theoretical model. SMVM = Shirom-Melamed Vigor Measure; UWES-9 = 9-items Utrecht Work Engagement Scale.

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Table 3. Summary of goodness-of-fit indexes for study 2 CFA and MTMM models

Model	*df*	χ^2	TLI	CFI	RMSEA (90% CI)	SRMR	AIC
CFA UWES-9	23	131.75	.93	.95	.07 (.06–.08)	.04	175.711
CFA F-SMVMv2 (with 12 items from the original SMVM)	51	159.54	.92	.94	.08 (.07–.09)	.06	237.839
CFA F-SMVMv2 (with 15 items)	87	267.94	.92	.93	.08 (.07–.09)	.05	363.941
CFA F-SMVMv2 (with 12 items selected on the basis of the previous model)	50	108.05	.96	.97	.06 (.04–.08)	.04	188.046
CT-C(M-1)	169	458.57	.95	.96	.07 (.06–.08)	.06	582.542

Notes. AIC = Akaike Information Criterion; CFA UWES-9 = Confirmatory Factorial Analysis of the Utrecht Work Engagement Scale-9; CFA F-SMVMv2 = Confirmatory Factorial Analysis of the second French version of the Shirom Melamed Vigor Measure; CFI = Comparative Fit Index; CT-C(M-1) = Correlated Trait-Correlated Method Minus One; *df* = Degree of Freedom; MTMM = Multitrait-Multimethod; RMSEA = Root Mean Square Error of Approximation; SRMR = Standardized Root Mean Squared Residual; TLI = Tucker-Lewis Index.

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Results

Descriptive Statistics

Univariate and multivariate normality were examined. The results showed that univariate skewness and kurtosis values were lower than 1 and Mardia's multivariate skewness and kurtosis values were lower than 3. Actually, some researchers recommend to use maximum likelihood estimation when there are five or more categories in the scale, when sample size is small, and when category thresholds are approximately symmetric (Rhemtulla et al., 2012). Moreover, it is possible to find true parameter values in factor analysis with Likert scale data, if assumptions about skewness and kurtosis are met (Lubke & Muthén, 2004). Table 2 indicates that latent correlations between the three UWES-9 subscales range between .93 and .98, whereas latent correlations between the three F-SMVMv2 subscales range between .45 and .78. Moreover, regarding the correlations between the two measures, unlike what should has been expected, all SMVM subscales show the highest correlations with the vigor subscale of the UWES-9. Inspection of the factorial structure of the UWES-9 with three factors in the present study revealed acceptable fit indices for SRMR, CFI, TLI, and RMSEA (Table 3).

Reliability and Factorial Validity of the F-SMVMv2

As in the previous study, we tested the three-dimensional first-order structure in order to be able to use this structure in MTMM analyses. However, as studies have shown that the hierarchical structure was also valid (Bilgel et al., 2012; Little et al., 2011; Shirom et al., 2008; Wefald et al., 2012), we tested this structure for each of the models presented below. Standardized factor loadings, correlations of the latent constructs, standardized residual variances, and fit indices of the models presented subsequently are shown in ESM 3. The results of these analyses showed that for each of the models the structure with three first order dimensions is better than the hierarchical structure. First, we examine the measurement model that specified the 3-factor F-SMVMv2 with the 12 original items of the SMVM reformulated. The fit indices of the measurement model that specified the 3-factor F-SMVMv2 with 12 items reached reasonable values for SRMR, CFI, TLI, and RMSEA (Table 3). Then, we examined the measurement model that specified the 3-factor F-SMVMv2 with the 12 original items of the SMVM reformulated and the three items created in the present study. The fit indices of the measurement model that specified the 3-factor F-SMVMv2 with 15 items reached reasonable values for SRMR, CFI, TLI, and RMSEA (Table 3). In order to refine the model, inspection of the modification indices given by the AMOS software revealed that one item exhibited cross-loadings on other subscales of the F-SMVMv2 (emotional energy 15 with cognitive liveliness subscale, $\Delta\chi^2$ = 16.49), and that three items have a high shared covariance with items from other subscales (physical strength 3 with cognitive liveliness 2, physical strength 9 with emotional energy 8, physical strength 9 with emotional energy 4, and emotional energy 15 with cognitive liveliness 11; $\Delta\chi^2$ ranged between 4.94 and 14.39). Moreover, modification indices also suggested to add an error covariance between two items of the cognitive liveliness subscale (cognitive liveliness 5 with cognitive liveliness 10, $\Delta\chi^2$ = 55.37). As these two items represent the "creative" component of cognitive liveliness (whereas the two other items of this dimension represent the "alertness" component), it seems reasonable to add this error covariance in the following analyses. Based on these modification indices, a revised model without physical strength 3, physical strength 9 and emotional energy 15 items, and with an error covariance between cognitive liveliness 5 and cognitive liveliness 10, showed better fit indices (Table 3).

The reliability of the F-SMVMv2 was then assessed by examining Cronbach's alpha coefficients of the last model with three subscales of four items each. The results provided evidence for the adequate internal consistency (i.e., Cronbach's αs between .78 and .91; Table 2).

Convergent and Discriminant Validity of Work Engagement

The CT-C(M-1) model presented in Figure 1 showed acceptable fit indices (Table 3). The correlations between trait factors (*r*s from .91 to .98; Table 4) were high (> .70; Eid et al., 2008), indicating low discriminant validity

Table 4. Trait and method factor correlations in the CT-C(M-1) Model with UWES-9 as standard method

	1	2	3	4	5	6
1. Trait 1 – Physical work engagement	_					
2. Trait 2 – Cognitive work engagement	.95 (.07)	_				
3. Trait 3 – Emotional work engagement	.91 (.06)	.98 (.07)	_			
4. SMVM21 (physical strength)				_		
5. SMVM22 (cognitive liveliness)				.61 (.03)	_	
6. SMVM23 (emotional energy)				.22 (.02)	.35 (.03)	_

Notes. CT-C(M-1) = Correlated Trait-Correlated Method Minus One; SMVM = Shirom Melamed Vigor Measure; UWES-9 = Utrecht Work Engagement Scale-9.

Table 5. Standardized loadings in CT-C(M-1) model with UWES-9 as a standard method

	T1	T2	T3	M21	M22	M23	CC	MS
Physical work engagement								
UWES-9								
Vigor 2	.84							
Vigor 5	.73 (.06)							
Vigor 8	.83 (.05)							
SMVM								
Phy. S. 1	.65 (.06)			.46			.63	.37
Phy. S. 7	.66 (.06)			.58 (.12)			.77	.23
Phy. S. 11	.62 (.06)			.56 (.12)			.70	.30
Phy. S. 13	.65 (.06)			.57 (.13)			.75	.25
Cognitive work engagement								
UWES-9								
Dedication 4		.87						
Dedication 7		.88 (.05)						
Dedication 9		78 (.05)						
SMVM								
Cog. Liv. 2		.48 (.06)			.49		.47	.53
Cog. Liv. 5		.50 (.06)			.35 (.13)		.38	.62
Cog. Liv. 10		.47 (.06)			.31 (.13)		.31	.69
Cog. Liv. 14		.50 (.06)			.70 (.19)		.75	.25
Emotional work engagement								
UWES-9								
Absorption 1			.83					
Absorption 3			.73 (.06)					
Absorption 6			.76 (.06)					
SMVM								
Emot. En. 4			.38 (.07)			.56	.46	.54
Emot. En. 6			.39 (.07)			.58 (.12)	.49	.51
Emot. En. 8			.33 (.07)			.59 (.13)	.46	.54
Emot. En. 12			.25 (.07)			.74 (.15)	.61	.39

Notes. CT-C(M-1) = Correlated Trait-Correlated Method Minus One; UWES-9 = Utrecht Work Engagement Scale-9; SMVM = Shirom Melamed Vigor Measure; T = Trait; M = Method; CC = Consistency Coefficient; MS = Method Specificity; Phy. S. = Physical Strength; Cog. Liv. = Cognitive Liveliness; Emot. En. = Emotional Energy.

between the different traits of the UWES-9 (i.e., traits cover resembling constructs). This result is concordant with the meta-analysis by Christian et al. (2011) and the review by Kulikowski (2017) which showed that the three subscales of the UWES were highly correlated, thus suggesting multicollinearity.

Regarding method specificity and consistency coefficients (Table 5), the standard method (UWES-9) explained between 31% and 77% of the variance in the F-SMVMv2 items. The four physical strength items have consistency coefficients higher than 50%, indicating consistency with the standard method's definition of physical work engagement. Concerning emotional energy and cognitive liveliness, for each scale only one item has a consistency coefficient higher than 50% and three items have consistency coefficients lower than 50% indicating more method specificity of these items with the standard method's definition of emotional and cognitive work engagement.

Conclusion

Results of the CFA revealed good factorial validity of the F-SMVMv2 when an error covariance is set between two items of the cognitive liveliness subscale which represent the "creative" component of this subscale, the remaining variance thus representing the "alertness" component. Results of the CT-C(M-1) model revealed low discriminant validity between the different traits of the UWES-9. This result is in line with past studies' results which have shown that the three subscales of the UWES were highly correlated (for a meta-analysis and a review see Christian et al., 2011; Kulikowski, 2017), suggesting multicollinearity. Schaufeli and Salanova (2007) highlighted that a one-factor model is also supported in their measure of work engagement. Results also showed that the F-SMVMv2 and the UWES-9 displayed good convergent validity for the physical engagement dimension, with consistency coefficients higher than 50%. However, consistency coefficients regarding emotional and cognitive work engagement failed to show convergent validity for these two dimensions of engagement.

Study 3: Concurrent Validity

Acceptable reliability and factorial validity do not ensure that a scale is actually measuring what it is supposed to. It is of almost importance to specify the relationships of

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the underlying constructs assumed to be measured by the scales with other theoretically related constructs. The objective of this third study was therefore to assess concurrent validity through relationships between work motivation, job satisfaction and the subscales of the F-SMVMv2. Moreover, as proposed by Wefald et al. (2012), the objective of this third study was also to examine the contribution of both the F-SMVMv2 and the UWES-9 in the variation of work motivation and job satisfaction. Actually, Wefald et al. (2012) have highlighted that the UWES provides considerable predictive validity of job satisfaction (i.e., an affect experience in the work) and affective commitment (i.e., being completely captivated by work) which both represent how a person feels when he/she is at work, whereas the SMVM may provide better insight into what a person feels about his or her job.

Self-determination theory posits that work motivation represents the underlying reasons that encourage people to achieve their work activities (Deci & Ryan, 2008). It ranges from amotivation (i.e., lack of motivation whatever it is), to four types of extrinsic motivation (i.e., *external* being the more controlled type of extrinsic motivation, and *introjected*, *identified*, and *integrated* being progressively more autonomous), and finally *intrinsic motivation* (i.e., which is invariantly autonomous). Thus, motivational processes in organizations represent individuals' decisions to allocate energy from their energetic resources over time among different activities. Consequently, vigor and engagement have been linked to motivation at work and job satisfaction (Forgas & George, 2001; Gillet et al., 2013; Shirom, 2011; Wefald & Downey, 2009). As a result, the three dimensions of vigor and the three dimensions of work engagement are expected to be positively related to autonomous motivation and job satisfaction, and negatively related to controlled motivation.

Method

Participants and Procedure

The same participants from study 2 were involved in the present study and followed the same procedure.

Measures

Vigor

The revised F-SMVMv2 developed in the previous study was used. It consists of 12 items scored on a 7-point frequency scale ranging from 1 (= *almost never*) to 7 (= *almost always*), assessing *physical strength* (four items), *emotional energy* (four items), and *cognitive liveliness* (four items). Respondents were requested to indicate the frequency of experiencing each of the described states during the previous 30 workdays.

Engagement

The short French version (Gillet et al., 2013) of the UWES known as the UWES-9 (Schaufeli et al., 2006) was used. This measure consists of nine items scored on a 7-point frequency scale ranging from 1 (= *almost never*) to 7 (= *almost always*), assessing *vigor* (three items; e.g., "In my job, I feel strong and vigorous"), *dedication* (three items; e.g., "I'm enthusiastic about my job"), and *absorption* (three items; e.g., "When I am working, I forget everything else around me"). The validity and reliability of the French version of this scale were supported in previous studies (e.g., Gillet et al., 2013).

Work Motivation

The external, introjected, identified regulations, and intrinsic motivation subscales of the French version of the Multidimensional Work Motivation Scale (MWMS; Gagné et al., 2015) were used to measure employees' motivation. On the basis of these four subscales, it is possible to compute an autonomous motivational regulation index (i.e., Intrinsic motivation $\times$ 2 + Identified regulation $\times$ 1; α = .72) and a control motivational regulation index (i.e., External regulation $\times$ 2 + Introjected regulation $\times$ 1; α = .80) (Hagger et al., 2014).

Job Satisfaction

The five items of the French version of the Professional Life Satisfaction Scale (Fouquereau & Rioux, 2002) were used to measure employees' job satisfaction (α = .88).

Statistical Analysis

Multiple linear regressions with the two types of motivation and job satisfaction as dependent variables were performed with SPSS 20 program. The complete data are listed in ESM 2. For each dependent variable, the three subscales of the F-SMVMv2 were entered as predictors in a first analysis, and then the three subscales of the UWES-9 were entered as predictors in a second analysis. Table 6 reports the results of these multiple linear regressions. In addition, in order to test whether F-SMVMv2 can explain the variance in the dependent variables beyond the variance explained by the UWES-9, a series of multiple hierarchical regressions was conducted for each of the dependent variables with the three dimensions of the UWES-9 and the three dimensions of the F-SMVMv2 entered in two separate blocks as independent variables.

Results

Inspection of the correlation matrix (Table 6) revealed that the three dimensions of the F-SMVMv2 and the three dimensions of the UWES-9 were positively correlated to

Table 6. Correlation matrix of study 3 measures

	Autonomous motivation	Controlled motivation	Job satisfaction
Physical strength (Shirom)	.53***	−.44***	.50***
Cognitive liveliness (Shirom)	.49***	−.33***	.36***
Emotional energy (Shirom)	.36***	−.16**	.24***
Vigor (Schaufeli)	.72***	−.50***	.56***
Absorption (Schaufeli)	.67***	−.48***	.50***
Dedication (Schaufeli)	.84***	−.52***	.67***

autonomous motivation and job satisfaction, and negatively correlated to controlled motivation.

Multiple linear regression analyses were then conducted to test how the three dimensions of the F-SMVMv2 and the three dimensions of the UWES-9 contributed to the variation in autonomous and controlled work motivation, and job satisfaction. The three subscales of the F-SMVMv2 explained 34% of the variance in autonomous motivation (R^2 = .34, F[3, 331] = 56.16, p < .001), 20% of the variance in controlled motivation (R^2 = .20, F[3, 331] = 27.52, p < .001), and 25% of the variance in job satisfaction (R^2 = .25, F[3, 331] = 38.51, p < .001). Specifically, all of the three subscales of the F-SMVM-v2 were significantly linked to autonomous motivation, and physical strength subscale was significantly linked to controlled motivation and job satisfaction (Table 7). The three subscales of the UWES-9 explained 71% of the variance in autonomous motivation (R^2 = .71, F[3, 331] = 263.19, p < .001), 30% of the variance in controlled motivation (R^2 = .30, F[3, 331] = 45.98, p < .001), and 45% of the variance in job satisfaction (R^2 = .47, F[3, 331] = 96.66, p < .001). Specifically, absorption was significantly linked to controlled motivation, and dedication was significantly linked to autonomous motivation, controlled motivation, and job satisfaction (Table 7). However, UWES-9 indices of multicollinearity (i.e., VIF between 2.76 and 4.04, Table 7) can be problematic because they can increase the variance of regression coefficients and make them unstable and difficult to interpret.

Multiple hierarchical linear regression analyses were then conducted to test whether F-SMVMv2 can explain the variance in the dependent variables above and beyond the variance explained by the UWES-9 among autonomous and controlled work motivation, and job satisfaction. Dedication of the UWES-9 explained 70% of the variance in autonomous motivation (R^2 = .70, F[1, 333] = 788.407, p < .001; β = .84, p < .001); Dedication and absorption of the UWES-9 and physical strength of the F-SMVMv2 explained 31% of the variance in controlled motivation (R^2 = .31, F[3, 332] = 49.524, p < .001; ΔR^2 = .023, p < .01; Dedication: β = −.28, p < .001, Absorption: β = −.16, p < .05, and Physical Strength: β = −.19, p < .01). Finally, dedication of the UWES-9 and physical strength of the F-SMVMv2 explained 48% of the variance in job satisfaction (R^2 = .48, F[2, 332] = 154.55, p < .001; ΔR^2 = .016, p < .001; Dedication: β = .59, p < .001 and Physical Strength: β = .16, p < .01).

Conclusion

The three dimensions of the F-SMVMv2 were correlated to autonomous and controlled motivation, and job satisfaction, giving evidence of concurrent validity of the F-SMVMv2. This concurrent validity is also confirmed by the significance of the three dimensions of F-SMVMv2 in the linear multiple regression with autonomous motivation as a dependent variable, and the significance of physical strength in the two linear multiple regressions with controlled motivation and job satisfaction as dependent variables. Therefore, F-SMVMv2 seems appropriate to measure work vigor in relation to theoretically related concepts of motivation and job satisfaction.

In order to compare the two measures (i.e., F-SMVMv2 and UWES-9), results of multiple linear regressions have revealed that, the three dimensions of the F-SMVMv2 were linked to autonomous motivation, whereas only the dedication dimension of the UWES-9 was linked to this outcome. Physical strength dimension of the F-SMVMv2 was linked

Table 7. Multiple linear regressions with autonomous motivation, controlled motivation and job satisfaction as dependent variables

Dependent variable	F-SMVMv2	β	*p*	VIF	UWES-9	β	*p*	VIF
Autonomous motivation	Physical strength	.35	< .001	1.69	Vigor	.05	.34	3.59
	Cognitive liveliness	.21	< .01	1.82	Dedication	.77	< .001	4.04
	Emotional energy	.14	< .01	1.27	Absorption	.03	.54	2.77
Controlled motivation	Physical strength	−.39	< .001	1.69	Vigor	−.17	.06	3.59
	Cognitive liveliness	−.10	.15	1.82	Dedication	−.26	< .01	4.04
	Emotional energy	.03	.58	1.27	Absorption	−.15	< .05	2.77
Job satisfaction	Physical strength	.43	< .001	1.69	Vigor	−.01	.88	3.58
	Cognitive liveliness	.07	.29	1.81	Dedication	.70	< .001	4.01
	Emotional energy	.06	.23	1.26	Absorption	−.05	.49	2.76

Notes. UWES-9 = Utrecht Work Engagement Scale-99; SMVM = Shirom Melamed Vigor Measure.

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to controlled motivation and job satisfaction, whereas dedication dimension of the UWES-9 was linked to these outcomes. Moreover, results of the hierarchical multiple linear regressions showed that F-SMVMv2 is able to explain some variance in controlled motivation and job satisfaction above and beyond the variance explained by the UWES-9. As a result, both tools represent valid measures and are complementary to examine possible consequences of engagement at work. However, results of the regression analyses with the UWES-9 subscales should be taken with caution as the multicollinearity of the three subscales was high.

General Discussion

The objective of the present multi-study was to develop a French version of the SMVM, and to test its construct, convergent, discriminant, and concurrent validity. Results support the construct validity of the F-SMVMv2, partially support the convergent and discriminant validity between the F-SMVMv2 and the UWES-9, and support the concurrent validity with work motivation and job satisfaction.

Firstly, the present results confirmed the theoretical assumptions and the validity of the F-SMVMv2 (after having tested a preliminary version and developed a reformulated version) by showing that the three dimensions of vigor conceptualized by Shirom (2003) exhibited good reliability (i.e., Cronbach's alpha coefficients above the recommended cut-off criteria) among French-speaking workers, and with a 3-factor analysis showing acceptable fit to the data after suppression of three items (i.e., physical strength 3, physical strength 9, and emotional energy 15) which exhibited cross-loadings and/or shared covariance. This three-factor model is in-line with studies that used the SMVM with English (Wefald et al., 2012), Turkish (Bilgel et al., 2012), Thai (Boonyasiriwat et al., 2017), Norwegian (Furunes & Mykletun, 2012), Spanish (Pulido-Martos et al., 2017), and Israeli (Shirom, 2003; Shirom et al., 2008) speaking participants. Furthermore, Wefald et al. (2012) showed that the model with three factors displayed a better fit to the data than a one-factor model. Consequently, the present results support and broaden previous studies by showing good factorial validity of the F-SMVMv2.

Secondly, the present study is the first to examine the convergent and discriminant validity of the SMVM and the UWES-9 with MTMM analysis. Actually, even though Wefald et al. (2012) have suggested that vigor as conceptualized by Shirom (2003) and work engagement as conceptualized by Schaufeli, Salanova, et al. (2002) are different constructs, it has recently been assumed that these two conceptualizations share some similarities (Wefald et al., 2012). Inspection of the correlations revealed higher correlations between UWES-9 than F-SMVMv2 subscales. This result is concordant with the meta-analysis by Christian et al. (2011) and the review by Kulikowski (2017) which showed that the three subscales of the UWES were highly correlated, suggesting multicollinearity. Schaufeli and Salanova (2007) highlighted that a one-factor model is also supported in their measure of work engagement, which was not the case of the SMVM in the study by Wefald et al. (2012). All F-SMVMv2 subscales showed the highest correlations with the vigor subscale of the UWES-9. The definition of the different subscales might partly explain this result. Indeed, the vigor subscale in the UWES-9 represents the energy of an employee at work, his or her capability to work (Bakker, Albrecht, & Leiter, 2011); and the three subscales of the SMVM represent the emotional, physical, and cognitive energetic capacities of an employee at work (Shirom, 2011). As a result, it could be assumed that these energetic capacities are more related to the vigor subscale of the UWES-9 than the two other dimensions which represent more motivational/ involvement components of work engagement (i.e., *dedication* [strong involvement in the work] and *absorption* [being completely captivated by the work]).

The results of the present study failed to show discriminant validity for the F-SMVMv2 and the UWES-9 with high correlations between the three traits showing that they cover similar constructs when the UWES-9 is taken as the standard method. However, in the past, the one factor model for both work engagement and vigor has been suggested as being admissible (Schaufeli & Salanova, 2007; Shraga & Shirom, 2009). Next, results of the present study confirmed that the F-SMVMv2 and the UWES-9 displayed good convergent validity for the physical work engagement dimension, with consistency coefficients higher than 50%. Consistency coefficients regarding cognitive work engagement failed to show convergent validity. However, it might be assumed that cognitive liveliness and dedication represent two different aspects of cognitive energy at work. The "cognitive liveliness" in the SMVM represents thinking skills and mental agility, whereas "dedication" in the UWES-9 represents strong involvement in the work, which represents two different types of cognitive resources at work. Finally, consistency coefficients regarding emotional work engagement failed to show convergent validity. However, it might be assumed that emotional energy and absorption refer to two different aspects of emotional energy at work. The "emotional energy" in the SMVM (i.e., individual ability to express sympathy and empathy toward others) refers to the emotional energy invested in the relationships to others at work, whereas "absorption" in the UWES-9 (i.e., being completely captivated by the work so that time passes quickly) refers to the emotional

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energy invested when the employee is at work. As a result, these findings suggested that the F-SMVMv2 and the UWES-9 are two different and valid measures of work engagement with three interrelated dimensions. Moreover, each of these measurement tools was valid but not redundant with the other on physical, emotional, and cognitive work engagement dimensions.

Finally, present study results provided evidence of concurrent validity of the F-SMVMv2 with work motivation and job satisfaction scale. The three dimensions of the F-SMVMv2 were correlated to autonomous and controlled motivation, and job satisfaction. That is to say, when the employees have high vigor and high work engagement, they also reported high autonomous motivation and job satisfaction, and low controlled motivation. These results are in line with past studies (Forgas & George, 2001; Gillet et al., 2013; Shirom, 2011; Wefald & Downey, 2009). Moreover, results of the multiple linear regression analyses revealed that the three dimensions of the F-SMVMv2 were linked to autonomous motivation, and physical strength dimension of the F-SMVMv2 was linked to controlled motivation and job satisfaction. Absorption dimension of the UWES-9 was linked to controlled motivation, and dedication dimension of the UWES-9 was linked to autonomous motivation, controlled motivation and satisfaction. Comparison of R-squared of the regression of F-SMVMv2 scores and UWES-9 scores on each dependent variable revealed that the UWES-9 explain more variance than the F-SMVMv2. However, hierarchical linear regression revealed that physical strength dimension of the F-SMVMv2 explains a part of the variance in controlled motivation and job satisfaction above and beyond the variance explained by the dedication and absorption dimensions of the UWES-9. In the UWES-9, it is the cognitive dimension (i.e., dedication) and emotional dimension (i.e., absorption) which are significantly linked to the dependent variables, whereas in the F-SMVMv2 it is the physical dimension (i.e., physical strength) which is significantly linked to the dependent variables. However, results of the regression analyses with the UWES-9 subscales should be taken with caution as multicollinearity coefficient of the three subscales were high. In conclusion, the two measures showed evidence of concurrent validity and might play a unique role in the prediction possible consequences of work engagement.

Limitations and Future Research Directions

Although this study contributes to current knowledge on the SMVM and the UWES-9, it has some limitations. First, in this study, the French translation of the SMVM was unsatisfactory, therefore the items had to be reformulated and adapted to the target population (i.e., French workers). Although this adaptation was carried out by a panel of experts, future studies will have to confirm its validity on larger samples of French-speaking workers. Second, concurrent validity was only tested on motivation and job satisfaction. Since Shirom's (2011) model also assumes positive consequences for the physical and mental health of employees, future studies will also have to test the concurrent validity of F-SMVMv2 on these indicators (e.g., physical fitness). Finally, longitudinal studies seem necessary in order to examine the antecedents associated to each measure and the contribution of each tool to the prediction of the consequences of work engagement. As a result, longitudinal studies examining antecedents and consequences of work engagement measured by the UWES and vigor measured by the SMVM are necessary.

Applied Implications

From an organizational psychology perspective, the F-SMVMv2 makes it possible to examine whether vigor among French-speaking employees is related to the positive consequences identified by Shirom (2011). This will then allow managers to implement strategies to promote vigor and its positive consequences at work. For example, having a valid questionnaire in French will encourage the use of this measure in the context of work. Measuring vigor will then make it possible to know the level of vigor of the employees and to look for the causes if this level is too low. This will then allow the improvement of management and supervision techniques in order to improve the employees' feeling at work. Furthermore, given the complementarity of the two measures (i.e., F-SMVMv2 and UWES-9) on the dimensions of engagement (i.e., F-SMVMv2 and UWES-9 measure two different types of cognitive resources and two different types of emotional resources), it seems essential to use these two measures in a complementary manner in order to have a broader view of the resources available for employees at work.

Conclusion

The present study provides validity evidence for the F-SMVMv2 and broadens knowledge on work engagement by showing convergent validity for the F-SMVMv2 and the UWES-9 with a MTMM analysis. These two scales thus represent two valid measures of the physical, cognitive, and emotional dimensions of engagement at work. Moreover, this study confirms assumptions regarding the links between vigor and engagement at work, and motivation and satisfaction by showing that vigor and work engagement are related to motivation and satisfaction at work.

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Electronic Supplementary Materials

The electronic supplementary material is available with the online version of the article at http://doi.org/10.1027/1015-5759/a000518.

ESM 1. Data (.xls)
Data file of Study 1.
ESM 2. Data (.xls)
Data file of Studies 2 and 3.
ESM 3. Figures (.docx)
Graphical representations of the CFA analyses of the F-SMVM-v1 and the F-SMVM-v2. The results of the analyses can be obtained on request from the first author.

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